USER'S MANUAL
Rev. 12/2004

CD3000M-2PH
THYRISTOR UNIT

From 125A to 700A

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CD3000M-2PH Thyristor Unit from 125A to 700A

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CAUTION

Thyristor units are used in power industrial equipment. When the thyristor unit is working, there are on the unit the following voltages
- Maximum main supply voltage on power terminals up to 600V.
- Auxiliary supply 230-460Vac.
- Fan voltage 230Vac 50/60Hz Power consumption 14W.

Don't remove the plastic cover which provides adequate protection against electric shock.
Don't use this thyristor in aerospace and nuclear application.

Electric Shock Hazard (Risque the choque électrique)

When thyristor unit has been connected to main supply voltage and is switched off, before to touch it be secure that the unit is isolated and wait at least one minute to permit to discharge internal capacitors. Thus be secure that:
- access to thyristor unit is only permitted to specialized personnel;
- the authorised personnel must read this manual before to have access to the unit;
- the access to the units must be denied to unauthorized personnel.

Important warnings(attention)
- Local regulations regarding electrical installation should be rigidly observed.
- Safety regulations must be rigidly observed.
- Don't bend components to maintain insulation distances.
- Protect the units from high temperature, humidity and vibrations.
- Don't touch components to prevent elettrostatichal discharges on them.
- Verify that all ratings are in line with real needs.
- If authorized personnel must measure voltage, current etc. on units, take away rings and other jewels from fingers and hands.
- Authorized personnel working on thyristor unit under power supply voltage must work on insulated board. Be secure that board is not connected to earth.

This listing does not represent a complete enumeration of all necessary safety cautions.

Protection(protection)
CD3000 thyristor family has a polymeric plastic cover in compliance to International specification IP20. To understand if IP20 protection is sufficient should be evaluated the installation place where the units are installed.
Open Type Equipment(équipment de type ouvert).
Maximum surrounding air temperature 40°C(Temperature de l'air environnante maximum 40°C).

Earth(terre)
CD3000 family has isolated heatsink. For safety connect the heatsink to earth to avoid shocks in case that circuit board or thyristors lost insulation. Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

Electronic Supply(alimentation électronique)
CD3000 family electronic circuit should be supplied by dedicated voltage supply for all electronic circuit but not in parallel with contactor's coil, solenoids and other inductive or capacitive loads. It's recommended to use a shielded transformer.

Electromagnetic compatibility (compatibilité électromagnétique)
Our thyristor unit has an excellent immunity to electromagnetic interferences if all suggestions contained in this manual are respected. In respect to a good Engineering practise, all inductive loads like solenoids contactor coils should have a filter in parallel.

Emissions (emission)
All thyristor switching at high speed generate some radiofrequency disturbance. CD3000 serie complies with EMC rules for CE mark. In many installations near electronic devices has not been noted problems. If radiofrequency device at low frequency are used near the thyristor unit, some precautions should be taken like line filters and shielded cables for input signal and for load cables.

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NOTE
We reserves the right to apply modifications to the our products without any advice.

1. Glossary

1.1 Terminology

V: voltage power supply.
I: the full circulating current in thyristor unit.
P: total load power.

1.2 Input signal

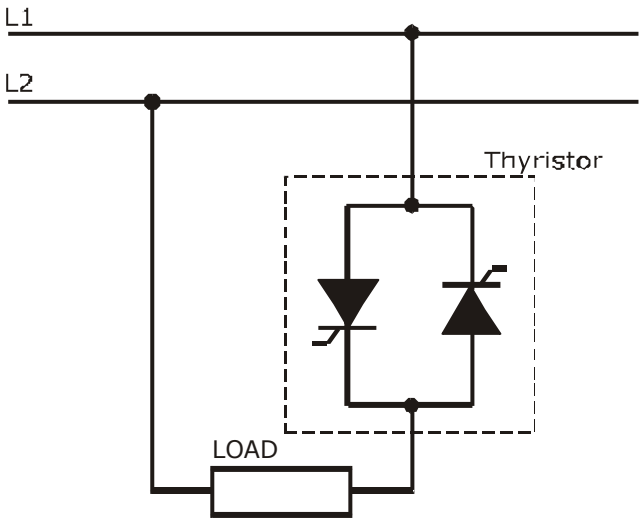
SSR: This input type is a square waveform generated by a temperature controller.
AN: Analog input.
IRS: Communication command.

1.3 Power feed back

Feedback: supply voltage fluctuation changes the power to the load. To overcome this effect the voltage supplied to the load is measured and compared with power demand from controller, the error signal is used to automatically hold the power at demanded level.

1.4 What is a thyristor unit

A thyristor unit is semiconductor device which acts as a switch formed by two thyristors in antiparallel. To switch on the alternating current the input signal will be on and the thyristor will switch off at first zero crossing voltage with no input signal. The benefits of thyristor units compared with elettromechanical contactors are numerouses: no mooving parts, no maintenance and capacity to switch very fast. Thyristors are the only solution to control transformers and special loads that change resistance with temperature and with age.



2. Technical specifications

2.1 General Features:

Operating temperature	0÷45°C for higher temperature see derating curve
Voltage power supply	24 V minimum, 480V max and 600 V on request
Input signal	SSR 4÷20 mA 0÷10V potentiometer (10k ohm) customer configurable with automatic zero/span calibration
Firing mode	One of these firing modes can be configured on line via serial port Zero Crossing (ZC) Fast Cycle (FC) Burst Firing (BF)
Auxiliary voltage supply	230 → 200÷230V ±15%; 10 VA power consumption 460 → 300÷460V ±15%; 10 VA power consumption
Fan voltage supply	230V ± 15 %; 110V ± 15 %; On request
Fuses	Internal
Heather break alarm	Discrimination better than 20%. Circuit microprocessor based to diagnose partial or total load failure and short circuit on Thyristors. Latching alarm plus reset. Relay output 0.5A at 125VAC
Line Drop Voltage	Automatic compensation ±15% of supply voltage with analog input
Mounting	Bulk head mounting
Protection	IP20

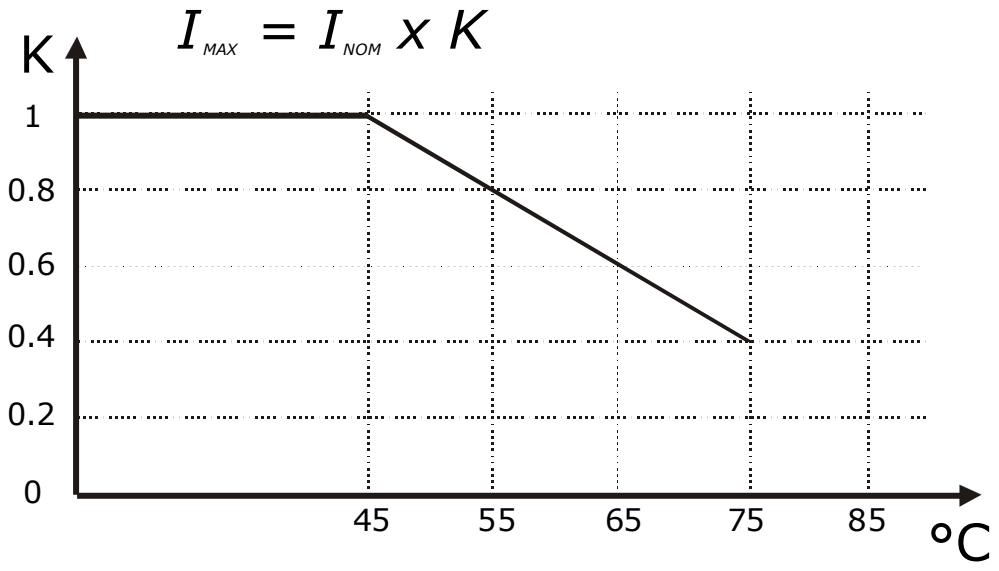
2.2 Input features

Input signal	**Maximum current drain**	**Input Impedance**	**ON condition**	**OFF condition**
SSR	5mA constant current		≥4V-max 30V	≤1V
Analog 0-10V	-	8200 ohm		
Analog 4-20mA	-	100 ohm		
Potentiometer 10 K ohm		8200 ohm		

2.3 Output features

Current	Voltage range	Ripetitive peak reverse voltage		Latching current	Max peak one cycle	Leakage current	I^2T value thyristor	Frequency range	Power loss	Isolation Voltage
(A)	(V)	(480V)	(600V)	(mAeff)	(10msec.) (A)	(mAeff)	tp=10msec	(Hz)	I=Inom (W)	Vac
125	24÷500	1200	1600	450	2000	15	19100	47÷70	255	2500
150	24÷500	1200	1600	300	5250	15	128000	47÷70	268	2500
200	24÷500	1200	1600	300	5250	15	128000	47÷70	380	2500
275	24÷500	1200	1600	300	4800	15	108000	47÷70	623	2500
400	24÷500	1200	1600	200	7800	15	300000	47÷70	875	2500
450	24÷500	1200	1600	200	7800	15	300000	47÷70	1021	2500
500	24÷500	1200	1600	200	8000	15	306000	47÷70	1061	2500
600	24÷500	1200	1600	1000	17800	15	1027000	47÷70	1178	2500
700	24÷500	1200	1600	1000	17800	15	1027000	47÷70	1425	2500

2.4 Derating curve



2.5 Fans

The thyristor units are equiped with a fan. The fan supply must be protected with a fuse.
Fan voltage supply is standard 230VAC ± 15% 50/60Hz or optional 110VAC ± 15% 50/60Hz.
The power consumption is given in the table below.

Size	CE Number of fans	UL Number of fans
125A, 150A, 200A	One Fan - 14W	One Fan - 14W
275A, 450A, 700A	Four Fan - 60W	Four Fan - 60W
400A, 500A, 600A	Two Fans - 30W	Four Fan - 60W

3.Ordering information

Model CD3000M 2PH

	1	2	3	4	5	6	7
CD3000M-2PH							
Ex:CD3000M 2PH/	**150A /**	**400V /**	**480V /**	**460V /**	**SSR/**	**ZC/**	**UL**

1	**Nominal current of CD3000M**					
125A		275A		500A		
150A		400A		600A		
200A		450A		700A		

2	**Operating Load Voltage (incoming voltage supply)**
Specify the value of the line supply.	

3	**Max VOLTAGE of CD3000M**
480V 600V	
The voltage on the identification label must be equal or more than operating voltage. The minimum voltage supply to the load is 24V.	

4	**Auxiliary Voltage**
230V	200÷230V ±15%; 10VA
460V	300÷460V ±15%; 10VA
600V	600V ±15%; 10VA (on request)

5	**Input**
SSR	4÷30VDC
0-10V	0÷10V analog input
4-20mA	4÷20mA analog input
10K pot	Potentiometer

6	**Firing**
ZC	Zero Crossing
BF	Burst firing. Specify the number on ON cycles at 50% of power.

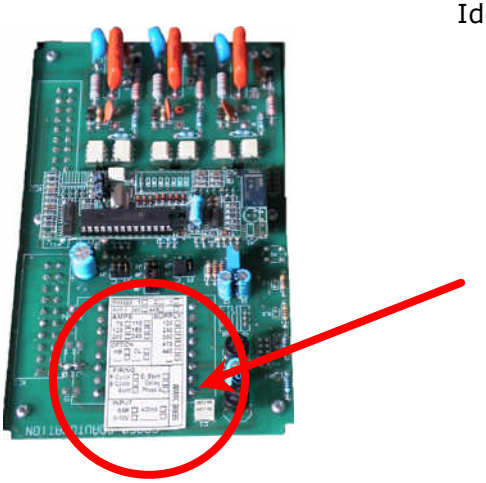
7	**Options**
COMM	MODBUS protocol in RS485 is standard
CD-KP	External Keypad
HB	Heater Break Alarm
FAN110	Fan voltage supply 110VAC ± 15% (std 230VAC ± 15%) 14W 50/60Hz
UL	UL Certification

4. Installation and wiring information

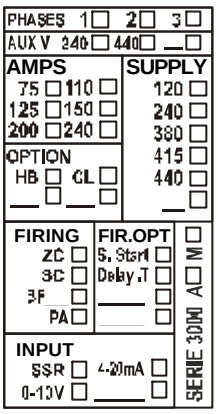
4.1 Identification of the unit

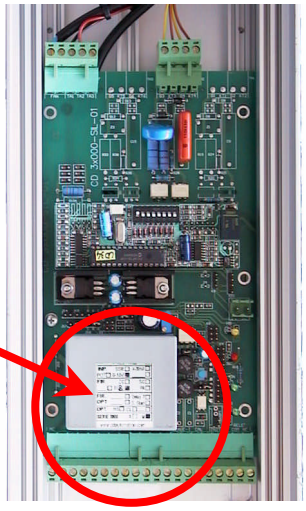
Before to install the CD3000M unit examine for damages or deficiencies. If any is found, notify the carrier immediately. Check that the product features shown on CD3000M identification label corresponds to that ordered.

An identification label provide all the informations regarding the factory settings of the unit. This label is on the board inside the unit, as represented below:



Identification Label

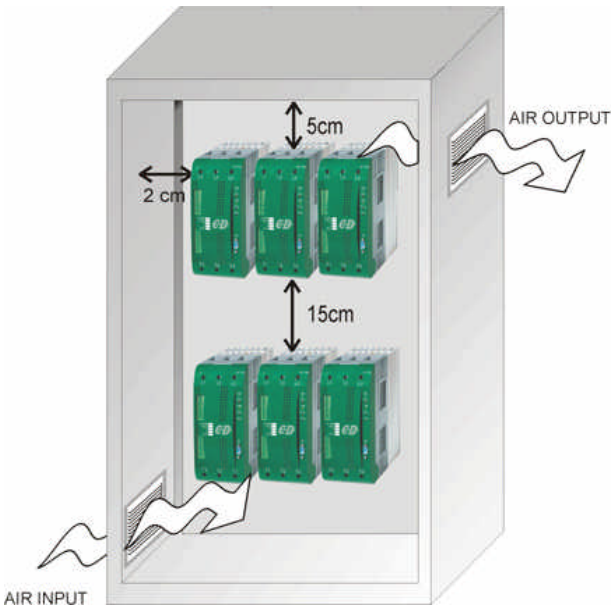




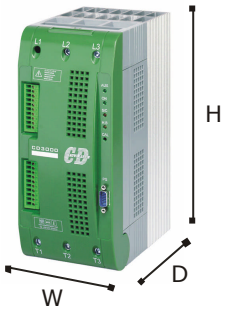
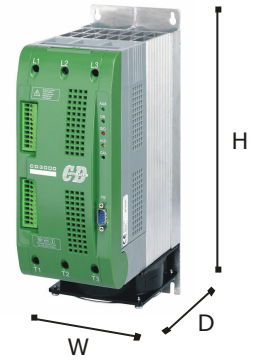
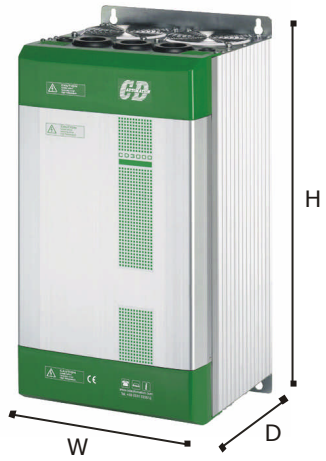
4.2 Installation

CD3000M unit should be always mounted in vertical position to improve air cooling on heatsink. Maintain minimum distances in vertical and in horizontal as below represented. Don't install in proximity of hot elements and near units generating electromagnetic interferences.

When more units are mounted inside a cubicle provide air circulation as below represented. Sometimes it is necessary to provide a fan to have better air circulation.

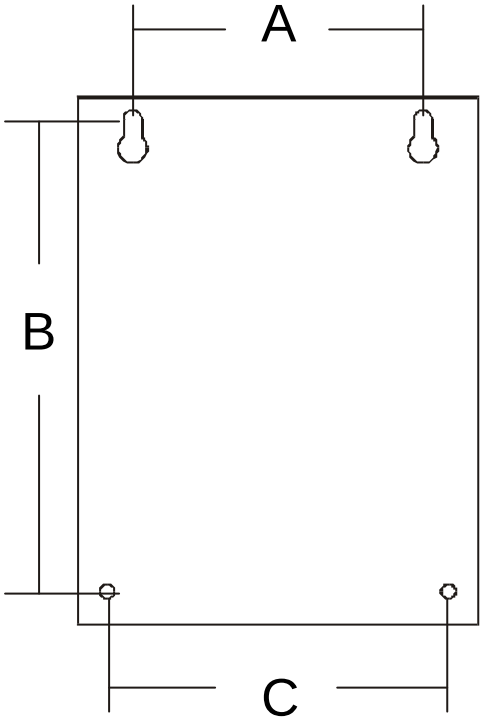


4.3 Dimensions

CD3000M 2PH 125-150A (S9)	CD3000M 2PH 200A (S10)	CD3000M 2PH 275A-700A (S14)
		

Size	W(mm)	H(mm)	D(mm)
125A (S9)	116	316	187
150A (S9)	116	316	187
200A (S10)	116	350	220
275A (S14)	262	520	270
400A (S14)	262	520	270
450A (S14)	262	520	270
500A (S14)	262	520	270
600A (S14)	262	520	270
700A (S14)	262	520	270

4.4 Fixing Holes



Size	A(mm)	B(mm)	C(mm)
125A (S9)	96	290	104
150A (S9)	96	290	104
200A (S10)	100	335	100
275A (S14)	222	495	222
400A (S14)	222	495	222
450A (S14)	222	495	222
500A (S14)	222	495	222
600A (S14)	222	495	222
700A (S14)	222	495	222

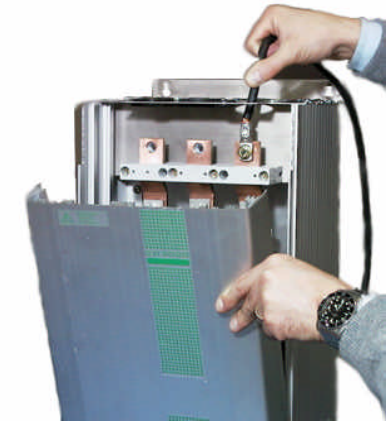
5. Wiring Instructions

5.1 Removing the cover

To open the unit apply as follow.

For S9 and S10 sizes, you must open the cover to configure the unit and to view the fuses

For S14 size, you must open the cover to cable, to configure the unit and to view the fuses



Warning: *this procedure can be done just by specialized personnel*

CD3000M unit has isolated heatsink. For safety connect the heatsink to hearth using its terminal with hearth symbol.

CD3000M can be susceptible to airborne interferences from near equipment or from interferences on main supply, so a number of precautions must be taken.

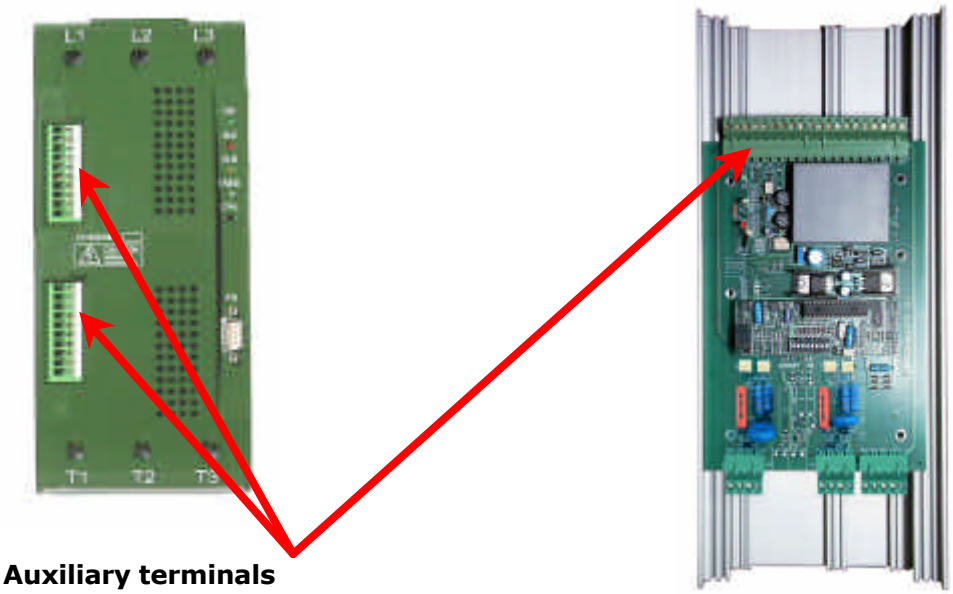
- Contactors coils and chokes must have in parallel a RC filter and must be supplied with a different voltage line.
- All input/output signal must use screened bifilar wires.
- Signal input and output must not routing in same cable try and must not be parallel.
- Local regulations regarding electrical installation should be rigidly observed.

5.1.1 Auxiliary Terminals

Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage.

Terminal	Description
1	Auxiliary supply voltage 230-460Vac (600V on request)
2	N.C. not connected
3	Auxiliary supply voltage 230-460Vac (600V on request)
4	N.C. not connected
5	Fan supply 240V (if mounted)
6	Fan supply 240V (if mounted)
7	Reset
8	Reset
9	+ Input command signal 4÷20mA, 0÷10V, SSR
10	- Input command signal 4÷20mA, 0÷10V, SSR
11	∅ Volt GND
12	Output + 8Vdc stabilized, 1mA max
13	+ Output command signal to CD3000 slave
14	- Output command signal to CD3000 slave
15	+ External HB Calibration command 24Vdc max
16	- External HB Calibration command 24Vdc max
17	Used for the future
18	NO HB relay alarm ** (coil not energized)
19	Common relay HB alarm
20	NC HB relay alarm ** (coil not energized)

** In alarm condition or without auxiliary voltage the coil is not energized. In normal condition (no alarm) the coil is energized.



Auxiliary terminals

5.1.2 Power Terminals

Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage.

Terminal	Description
L1	**Line Input Phase 1**
T1	**Load Output Phase 1 – controlled by the thyristor**
L2	**Line Input Phase 2**
T2	**Load Output Phase 2 – NOT controlled by the thyristor**
L3	**Line Input Phase 3**
T3	**Load Output Phase 3 – controlled by the thyristor**

5.2 Cabling detail

Use 75°C copper (CU) conductor only, provided with the terminal type indicated below.

<table>
<tr><th>Current/courant</th><th>Torque/couple
Lb-in (N-m)</th><th>Wire Range/cable</th><th>Wire
Terminal/terminal</th></tr>
<tr><td>125A, 150A,
200A, 225A</td><td>310 (35.0)</td><td rowspan="3">18 - 600kcmil</td><td>Polymeric Terminal
Block M8</td></tr>
<tr><td>275A</td><td>372 (42.0)</td><td>Bus Bar Adapter M8</td></tr>
<tr><td>400A</td><td rowspan="3">505 (57.0)</td><td rowspan="3">Bus Bar Adapter M10</td></tr>
<tr><td>450A, 500A</td><td rowspan="2">Bus Bar</td></tr>
<tr><td>600A, 700A</td></tr>
</table>

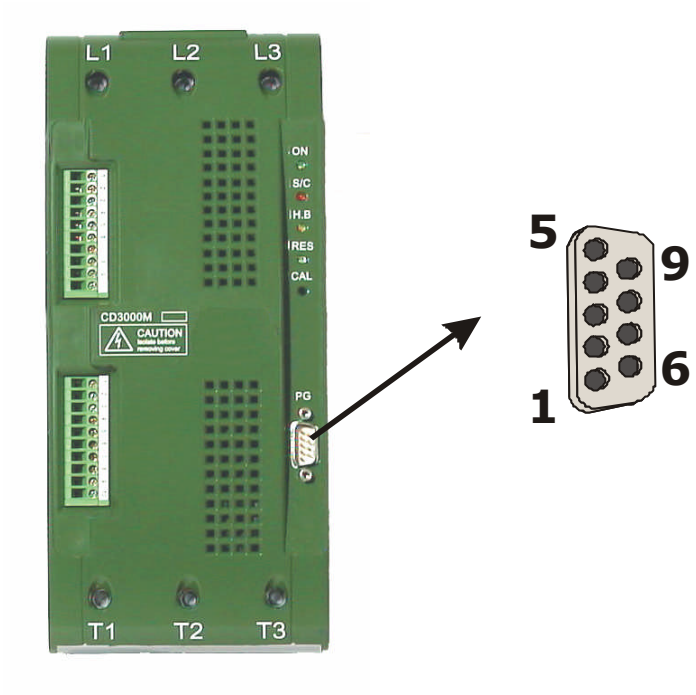
Power terminals: wire details:

Current	Supply L1, L2 and L3			Load T1, T2 and T3		
	Cable		Screw	Cable		Screw
	mm^2	AWG	M	mm^2	AWG	M
125A	50	1	M8	50	1	M8
150A	70	1/0	M8	70	1/0	M8
200A	95	3/0	M8	95	3/0	M8
225A	120	4/0	M8	120	4/0	M8
275A	2 x 70	2 x 1/0	M8	2 x 70	2 x 1/0	M8
400A	2 x 95	2 x 3/0	M10	2 x 95	2 x 3/0	M10
450A	Bus Bar		30 x 6 mm	Bus Bar		30 x 6 mm
500A	Bus Bar		60 x 4 mm	Bus Bar		60 x 4 mm
600A	Bus Bar		60 x 5 mm	Bus Bar		60 x 5 mm
700A	Bus Bar		60 x 6 mm	Bus Bar		60 x 6 mm

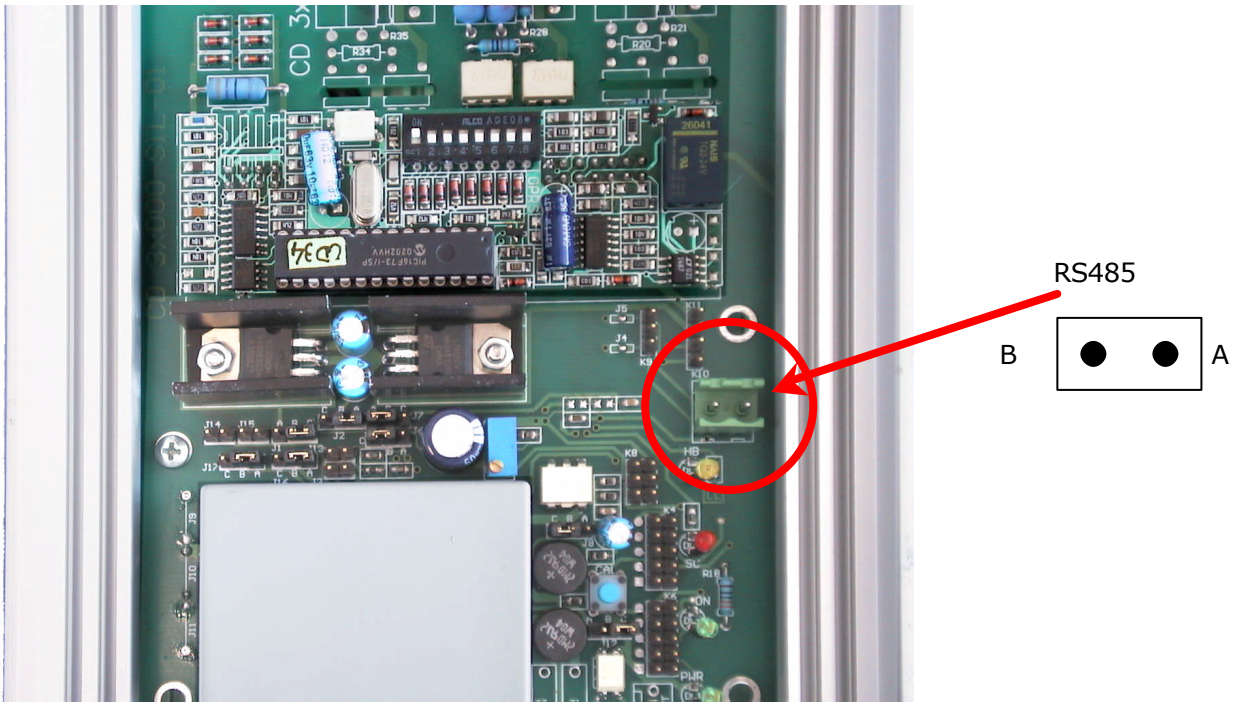
Auxiliary connectors and earth:

Current	Auxiliary Supply			Earth		
	Cable			Cable		Screw
	mm^2	AWG		mm^2	AWG	M
125A	0,50	18		16	6	M6
150A	0,50	18		16	6	M6
200A	0,50	18		25	4	M8
225A	0,50	18		35	2	M8
275A	0,50	18		50	1	M8
400A	0,50	18		50	1	M8
450A	0,50	18		70	1/0	M8
500A	0,50	18		70	1/0	M8
600A	0,50	18		70	1/0	M8
700A	0,50	18		70	1/0	M8

5.2.1 Serial Communication Terminals

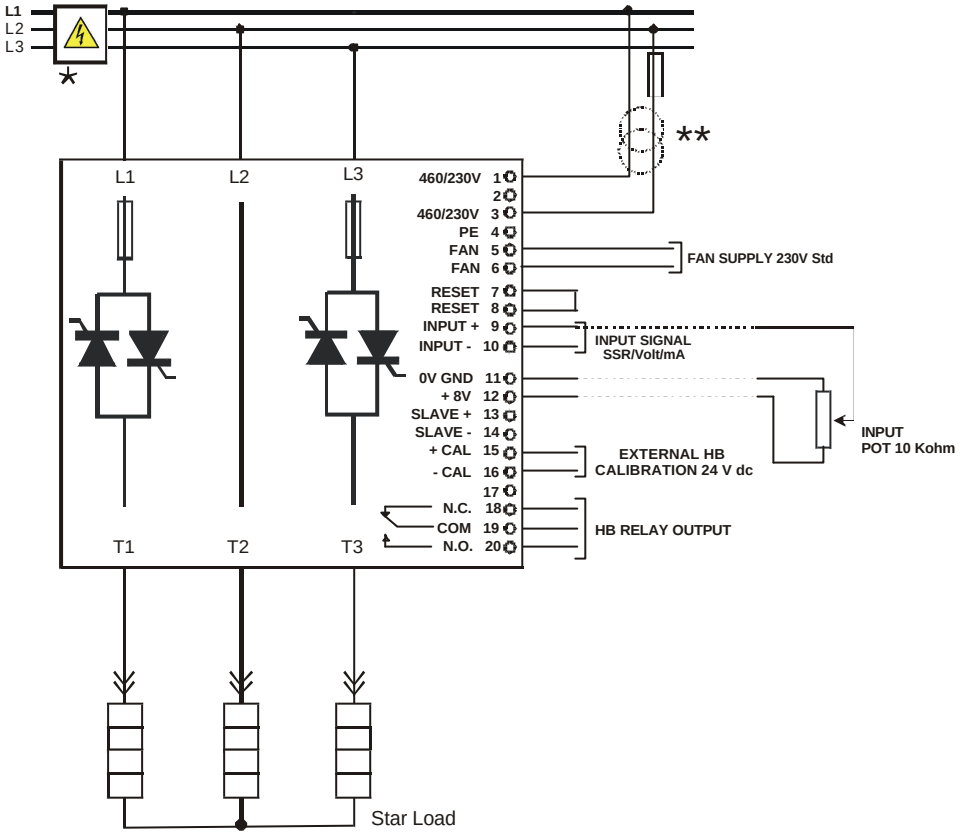


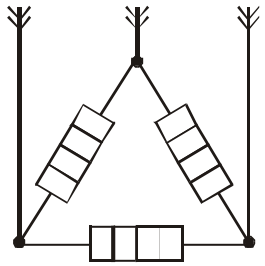
Pin 1	PMS5 (+5V)
Pin 2	GND 0V
Pin 3	GND 0V
Pin 4	Reserved (Rxd0)
Pin 5	GND 0V
Pin 6	RS485 A
Pin 7	RS485 B
Pin 8	nc
Pin 9	Reserved (Txd0)



5.3 Wiring connection

5.3.1 CD3000 125-700A





NOTE: IMPORTANT

* The user installation must be protected by electromagnetic circuit breaker or by fuse isalator.
The auxiliary voltage supply must be connected as above, and must be syncronized with load voltage power supply (L1, L2).

** If the auxiliary voltage (written on the identification label) is different from supply voltage (to the load), use an external transformer, as reported above.

To work terminals 7-8 must be linked.

Fan voltage supply is standard 230VAC ± 15% 50/60Hz or optional 110VAC ± 15% 50/60Hz. For power consumption see fan paragraph.

5.4 LED Status Table

LED	STATUS	DESCRIPTION
PW (green led)	○	Auxiliary supply is not connect
	●	Auxiliary supply is connect
ON (green led)	○	OFF Condition (Load IS NOT Powered)
	●	ON Condition (Load IS Powered)
SC (red led)	○	SCR OK
	●	SCR short circuit
HB (yellow led)	○	Laod OK
	●	Load Fault

○ = Light OFF	● = Light ON

6. Start up

Before to supply the thyristor unit:

- verify that load current equal or less than nominal;

For resistive load

$$I = \frac{P_{tot}}{V\sqrt{3}}$$

- verify that there is no short circuit on load;
- verify that main voltage equal or less than nominal;
- verify that all auxiliary connections are right and syncronized to main voltage!!!;
- Fan voltage equal than nominal (220-240V std, 110-120V optional)

After which supply thyristor unit giving the maximum input signal and verify that load current is equal or less than thyristor unit nominal current.

Warning: *this procedure can be done just by specialized personnel.*

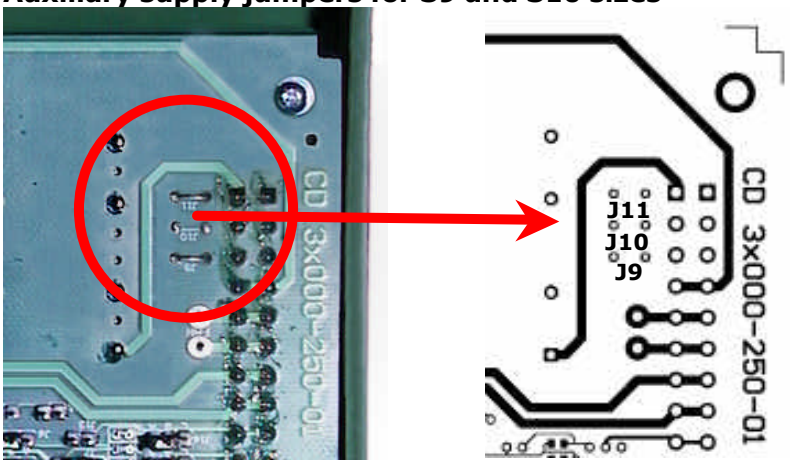
The thyristor unit is delivered configured and tuned in line with customer requirements. If it's necessary to change on site the configuration, procede as below specified.

6.1 Auxiliary supply

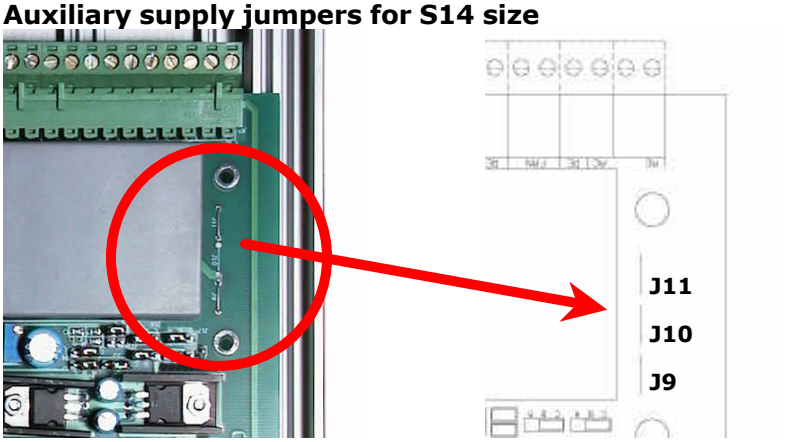
Warning: *this procedure can be done just by specialized personnel.*

To change auxiliary supply voltage sold the correct link-jumper on main PCB

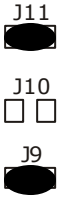
Auxiliary supply jumpers for S9 and S10 sizes



Auxiliary supply jumpers for S14 size



230V Auxiliary supply
To set the auxiliary power supply to 230V, close J9 and J11 and open J10 as shown below.



460V Auxiliary supply
To set the auxiliary power supply to 460V, close J10 and open J9 and J11 as shown below.

600V Auxiliary supply
This is a special version on request. In this case the unit is supplied already configured.

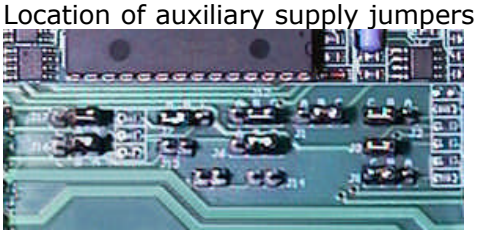
- If the Auxiliary Voltage (written on the identification label) is different from Supply Voltage (to the load), use an external transformer.
- If load voltage is not included in range of 230V ±15% or 460V +15% provide an external transformer with primary equal to load voltage and secondary 230V if your unit is setted to 230V.

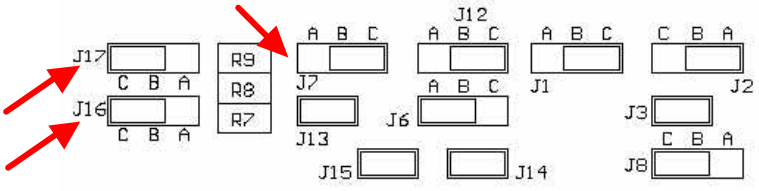
6.2 Analog input

CD3000M is delivered configured and tuned by CD Automation in line with customer's requirements. If it's necessary to change on site the configuration, procede as specified.
To change input type open cover and configure jumpers as represented below:

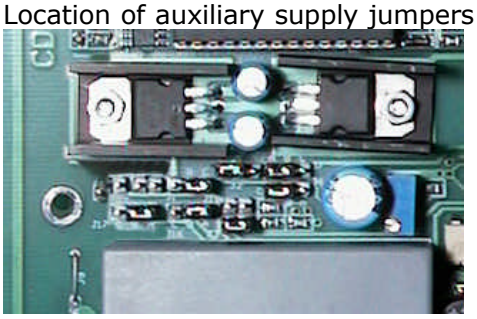
Warning: *this procedure can be done just by specialized personnel.*

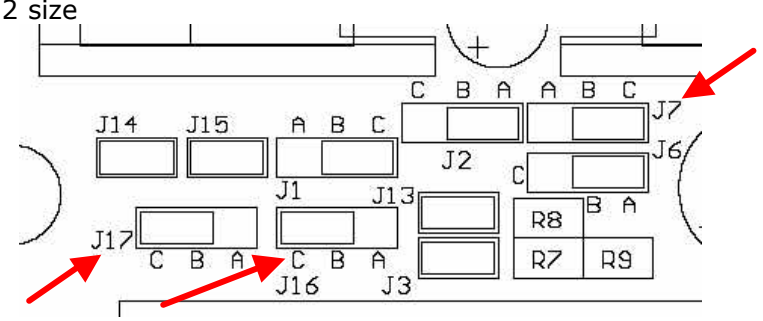
Location of auxiliary supply jumpers for S9 size





Location of auxiliary supply jumpers for S12 size

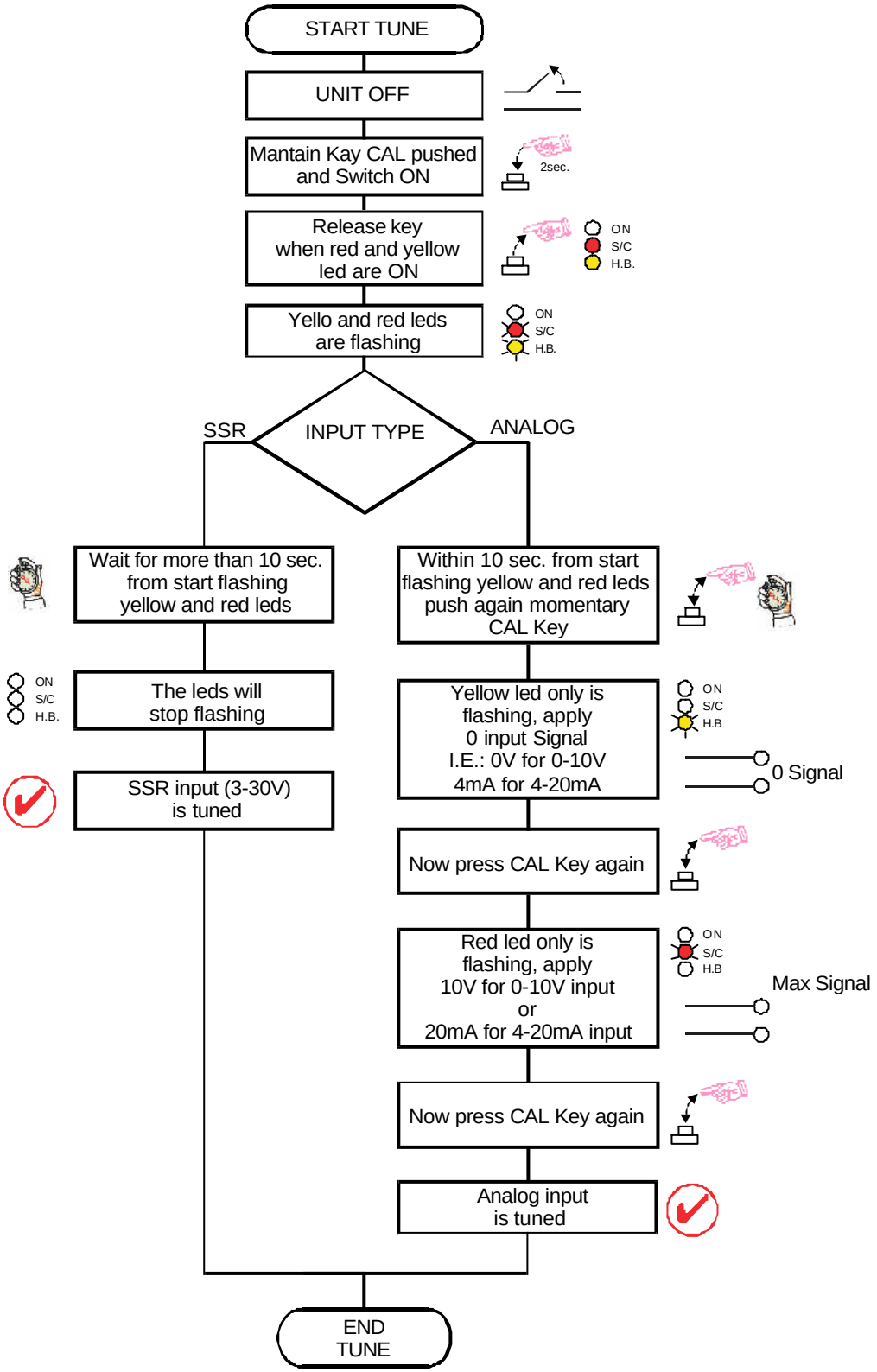




Jumpers Configuration			
	MAIN PCB		
Input	**J7**	**J16**	**J17**
SSR	A B C	C B A	C B A
0÷10V	A B C	C B A	C B A
4÷20MA	A B C	C B A	C B A

6.2.1 Tuning Analog input

Warning: *this procedure can be done just by specialized personnel.*



6.3 Heater Break Alarm

Heater Break Alarm is a microprocessor based circuit to diagnose partial or total load failure and short circuit on SCR and fuses failure.

The contacts of these relays are intented to be connected only to a Class 2 Power Supply or a Limited Voltage Limited Current source of supply with Class 2 characteristics.

- discrimination better than 20%;
- latching alarm plus reset.;
- relay output 0.5A at 125VAC.

H.B. circuit read load current via a current transformer 100-250/0.05 or 400-900/0.05 depending on the thyristor unit size. The current trasformers are internal to the unit..

Minimum current readable is 10% fo nominal current of the thyristor unit.

6.3.1 Heater Break Alarm indication

The Heater Break status is displayed with a relay and two leds, as the following table.

SC (red led)	○	SCR OK
	●	SCR short circuit
HB (yellow led)	○	Laod OK
	●	Load Fault

○: light OFF
●: light ON

6.3.2 H.B. Relay

The contact of the H.B. Relay is available on auxiliary terminals.

18	NC HB relay alarm ** (coil not energized)
19	Common relay HB alarm
20	NO HB relay alarm ** (coil not energized)

*** In alarm condition or without auxiliary voltage the relay coil is not energized. In normal condition (no alarm) the relay coil is energized.*

Switch cut-off capacity of the contact relay output is 0.5A at 125VAC.

6.3.3 Reset

To reset Heater Break Alarm open RESET contact on terminal 7-8.

6.3.4 Calibration (only with HB option)

This procedure is necessary to give the Heater Break set point. The unit reads the load current many times and when the value is the same for three times, takes it as set point.

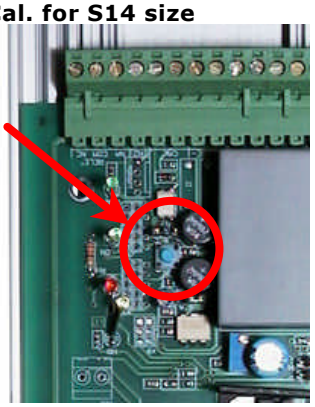
Calibration procedure:

- verify that connections are correct;
- supply the thyristor unit;
- push "CAL" button on front of the unit (for S9 and S10) or on the PCB board (for S14), or supply with 24Vdc terminals 15 (+) and 16 (-) or send command via RS485;
- the thyristor unit goes in conduction state to measure load current;
- all LEDS are ON, this means that calibration procedure is active;
- after one minute LEDS for H.B. and S/C switch off (calibration procedure is done);

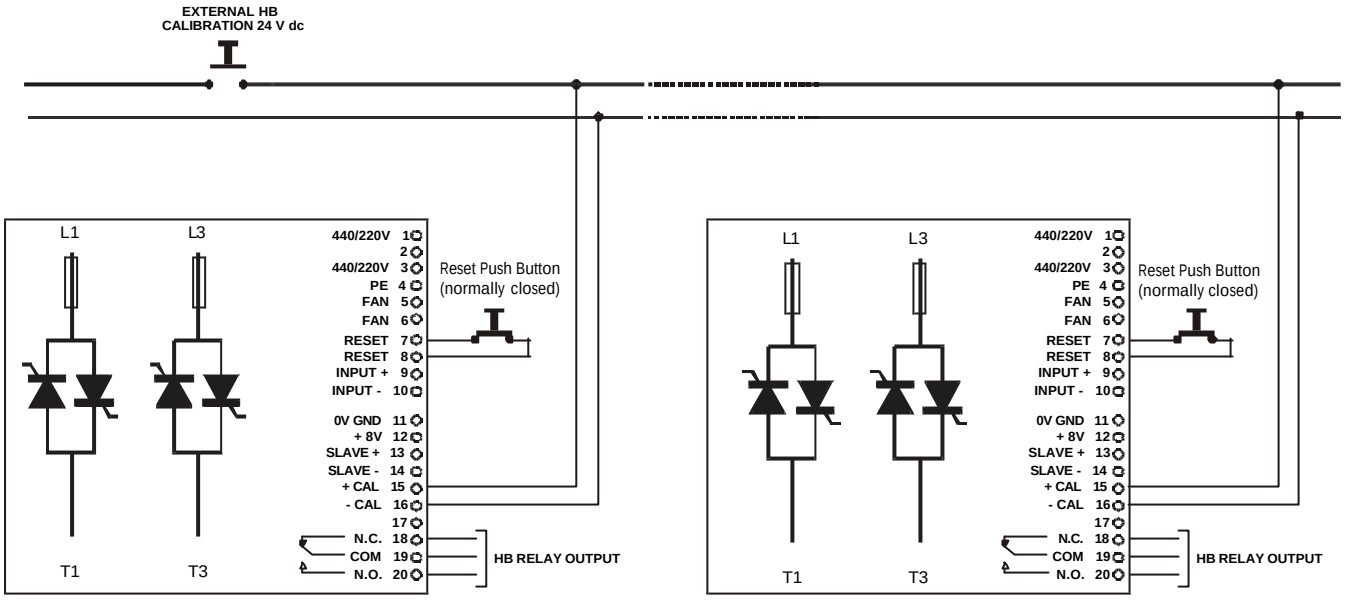
the thyristor unit is ready to work.

Cal. for S9 and S10 sizes

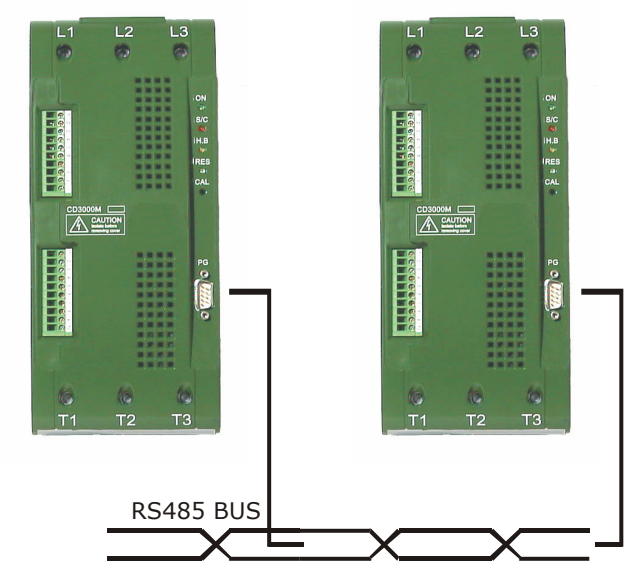
Cal. for S14 size



6.3.5 Digital input Command HB calibration



6.3.6 RS485 Command HB calibration

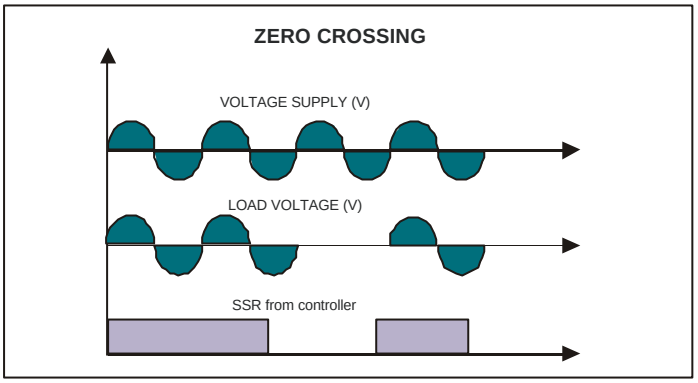


If load current decreases for partial or total load failure (sensitivity 20% standard Adjustable via RS485) the yellow LED becomes ON and alarm relay changes status.
If CD3000M is still in conduction with no input signal (LED green OFF) it means that there is a short circuit on thyristors and red LED (SC) becomes ON.

The diagnostic is active only when the switching period is longer than 60ms (3 main voltage cycle).

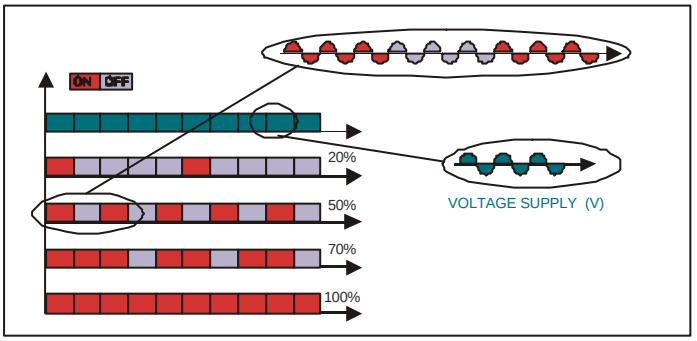
If the load has been changed calibration procedure must be done again.

7. Thyristor firing mode



7.1 Zero Crossing (ZC)

ZC firing mode is used with Logic Output from temperature controllers and the Thyristor operates like a contactor. The Cycle time is performed by temperature controller. ZC minimizes interferences because the Thyristor unit switches ON-OFF at zero voltage.

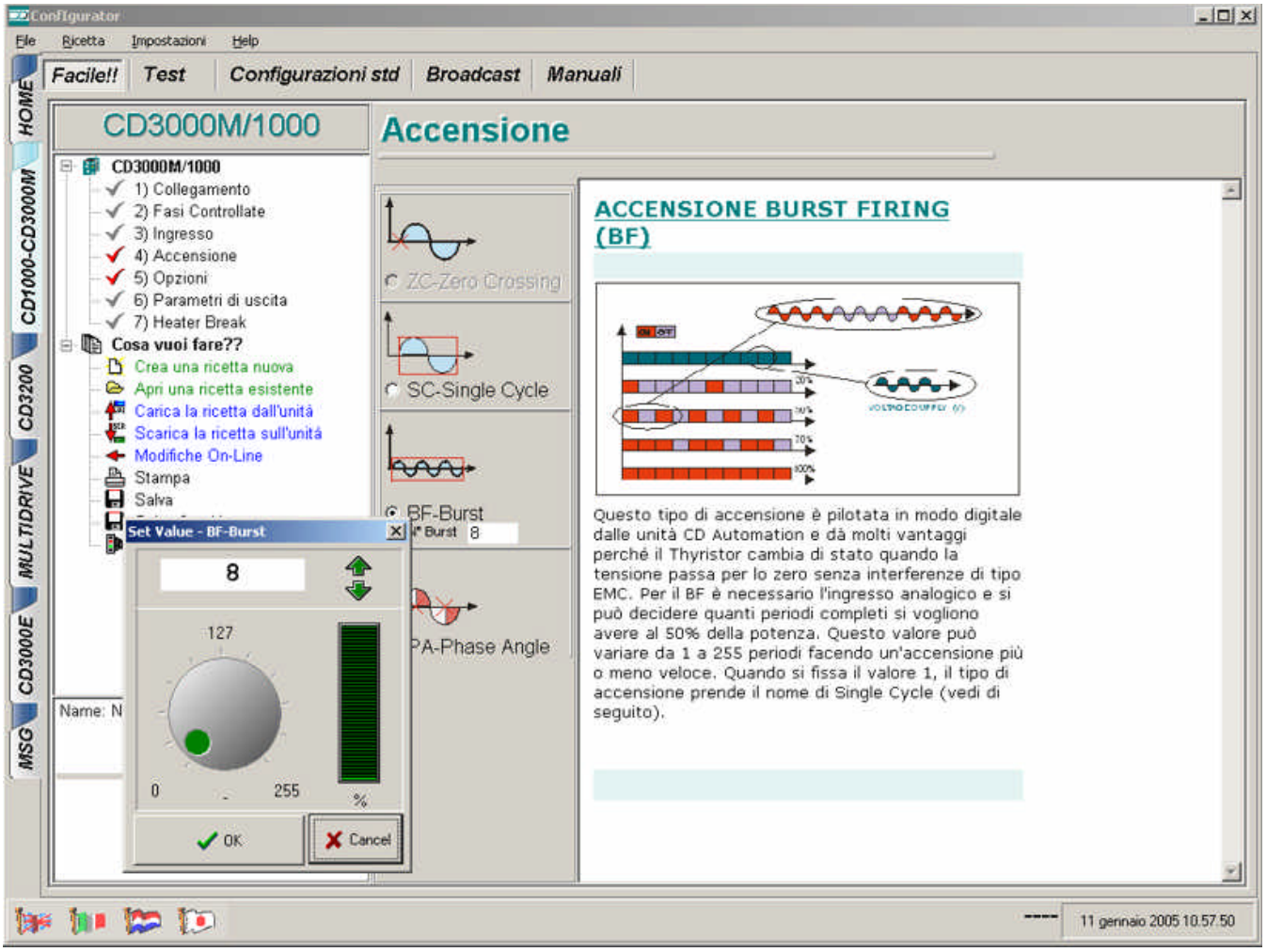


7.2 Burst Firing (BF)

This firing performed in Digital mode in CD Automation Thyristor unit gives a lot of advantages because switches Thyristor at zero voltage crossing without EMC interferences. Analog input is necessary for BF and can be decided how many complete cycles we want at 50% of power demand. This value can be implemented from 1 to 255 complete cycles doing the firing less or more fast. When 1 is setted the firing name becomes Single Cycle (see above).

7.3 Configurator

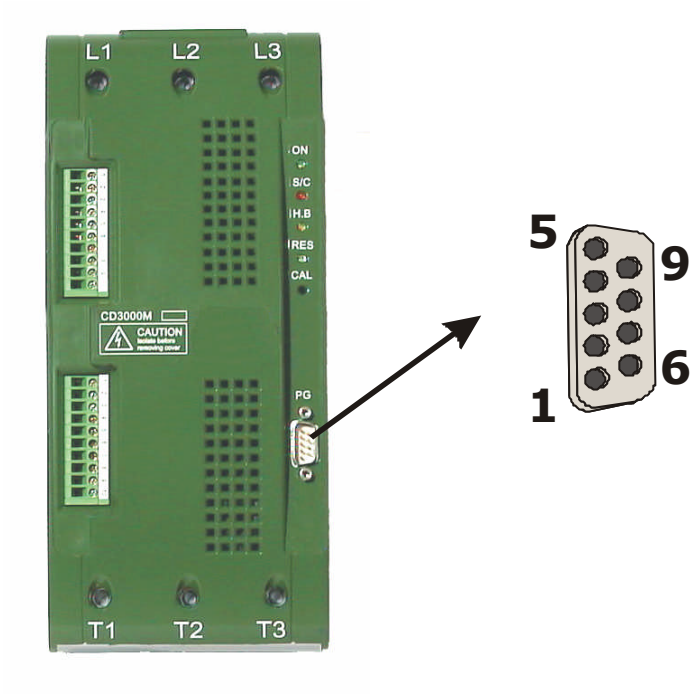
To configure CD3000M unit, you can download the free software and the Configurator Manual from our web site **www.cdautomation.com**.



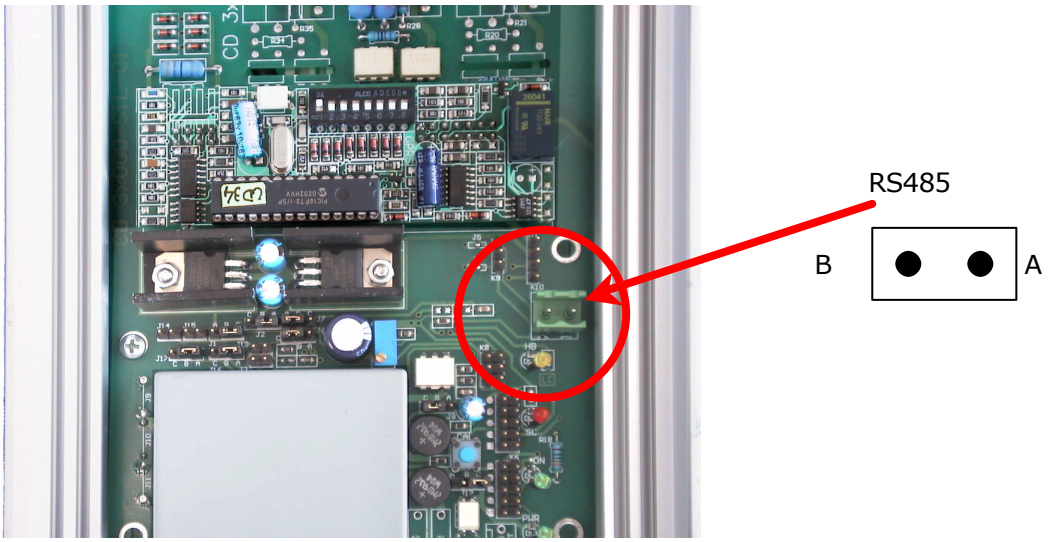
To configure the unit you can use the standard communication on RS485 port or use a programming cable with K11 connector.

7.3.1 RS485 standard communication port

If you use this port, you must have a RS232/485 converter.

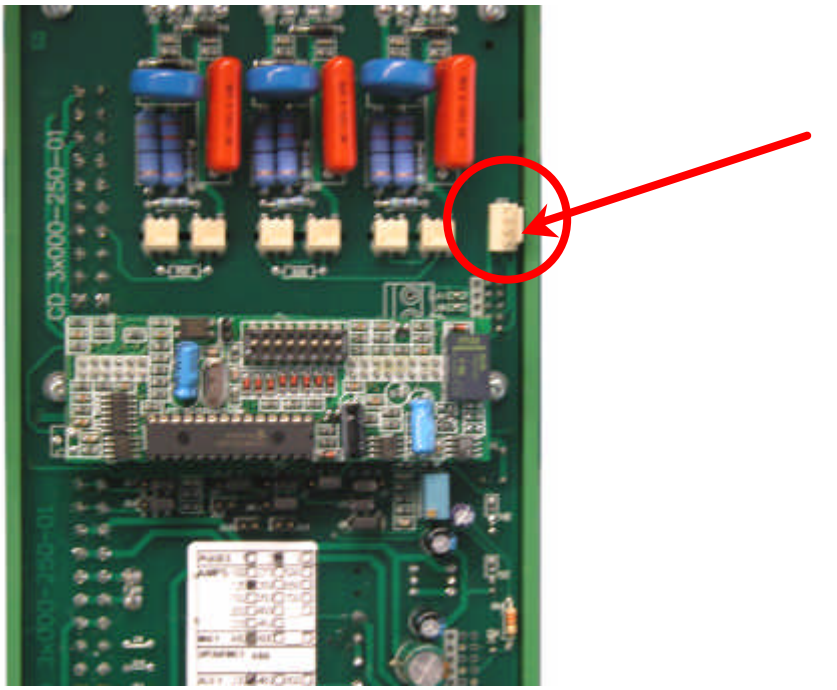


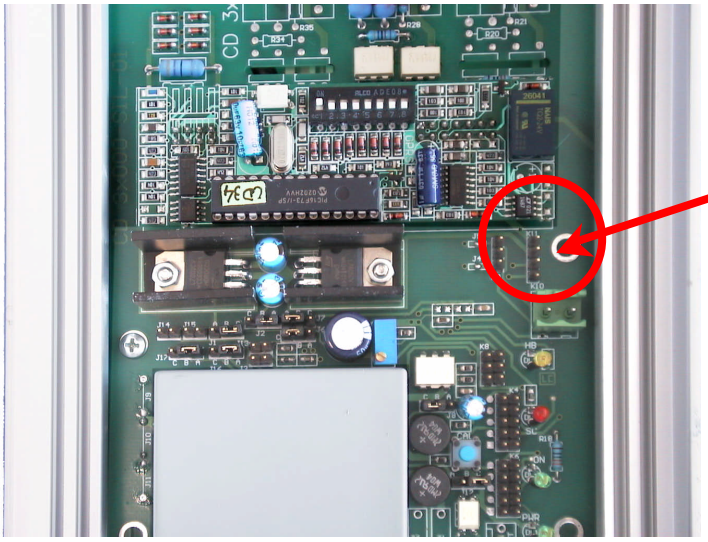
Pin 1	PMS5 (+5V)
Pin 2	GND 0V
Pin 3	GND 0V
Pin 4	Reserved (Rxd0)
Pin 5	GND 0V
Pin 6	RS485 A
Pin 7	RS485 B
Pin 8	nc
Pin 9	Reserved (Txd0)



7.3.2 Programming via K11 connector

If you use the K11 connector, you need the special programming cable supplied by CD Automation.





8. Fuses and fuseholder

8.1 Fuses and Fuse Code

CD3000M unit must be protected by fuses against short circuit selecting the proper I²t that must be lower than thyristor one. The same caution must be taken if Circuit Breaker is used. Remember that is very difficult to protect the thyristor if this choice is done.

WARNING!! Equipment short circuit protected by Semiconductor Fuse type with proper I^2t

Sizes	Bussmann Div - Cooper (UK) Ltd (200 kA_{RMS} Symmetrical A.I.C.)				Ferraz Shawmut SA (200 kA_{RMS} Symmetrical A.I.C.)			
	Fuse Mod. No. /modéle fusible	**Current (A_{RMS})**	**I^2t (A^2sec)**	**V ac**	**Fuse Mod. No. /modéle fusible**	**Current (A_{RMS})**	**I^2t (A^2sec)**	**Vac**
125A	200 FEE	200	11400	660	6,6 URY 000 BS88 200	200	16000	660
400A	550 FMM	550	215000	660	6,6 URZ 2X000 BS88 Z 550	550	208000	660
450A	2x 315 FM	315	77000	660	2 x 6,6 URB 000 BS88 315	315	82000	660
500A	2x 315 FM	315	77000	660	2 x 6,6 URB 000 BS88 315	315	82000	660
600A	2x 450 FMM	450	105000	660	2x 6,6 URZ 2X000 BS88 450	450	126000	660
700A	2x 450 FMM	450	105000	660	2x 6,6 URZ 2X000 BS88 450	450	126000	660
SIBA (300kA @ 600V, 200kA @700V)					FERRAZ (200kA @ 660V)			
150A	20 559 20	250	44000	660	6,6 URB 000 BS88/250	250	52000	660
200A	20 559 20	315	77000	660	6,6 URB 000 BS88/315	315	82000	660
275A	20 559 20	315	77000	660	6,6 URB 000 BS88/315	315	82000	660

High speed fuses are only used for the thyristor protection and can not be used to protect the installation.

The user installation must be protect by electromagnetic circuit breaker or by fuse isolator.

The warranty of thyristor is null if no proper fuses are used. See tab above.

9. Modbus communication

The CD3000M is equipped with two-wire RS485-compatible serial communications, by which means communication may occur between the Controller and a master device (e.g. a computer or terminal).

9.1 Physical requirements

9.1.1 Character Transmission

Data format is fixed to be one start bit, eight data bits, one stop bit, baud rate 9600 and the parity none.

9.2 ModBus RTU protocol

The standard RS485 Communications uses the industry standard MODBUS RTU protocol.
The following restrictions are imposed:

- *Baud rates is fixed to 9600 Baud only.*
- *Support for multi-parameter Write operations is limited to support of the Multi-Word Write Function (Number 16) but it permits the writing of only one parameter per message.*

The following MODBUS functions are supported:

Function	Function Number
Read Holding Registers (Read n Word)	03
Preset Multiple Registers (Write n Word)	16

The Controller will identify itself in response to a Read Holding Registers message which enquires the values of word parameters 121 and 122 (see Table 4-2).
MODBUS Function 17 (Report Slave ID) is not supported.

9.2.1Message Formats

The first character of every message is the Controller address, in the range 1 - 255 and 0 for broadcast messages.
The second character is always the Function Number.
The contents of the remainder of the message depends upon this Function Number.
In most cases the Controller is required to reply to the message by echoing the address and Function Number.

Broadcast messages are supported at address 0 (to which the CD3000M responds by taking some action without sending back any reply).

Data is transmitted as eight-bit binary bytes with one start bit, one stop bit and parity checking set to none. A message is terminated simply by a delay of more than three character lengths at the Baud rate used(in this case 9600 baud); any character received after such a delay is considered to be the potential address at the start of a new message.

Since only the RTU form of the protocol is supported, each message is followed by a two-byte CRC 16 (a 16-bit cyclic redundancy checksum).
This checksum is calculated in accordance with a formula which involves recursive division of the data by a polynomial, with the input to each division being the remainder of the results of the previous division.

The dividing polynomial is

$2^{16} + 2^{15} + 2^2 + 1$(Hex 18005)

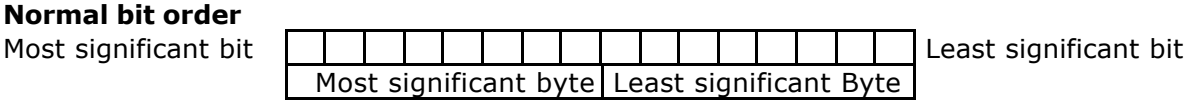
but this is modified in two ways:

- because the bit order is reversed, the binary pattern is also reversed, making the most significant bit (MSB) the right-most bit;
- because only the remainder is of interest, the right-most (most significant) bit can be discarded.

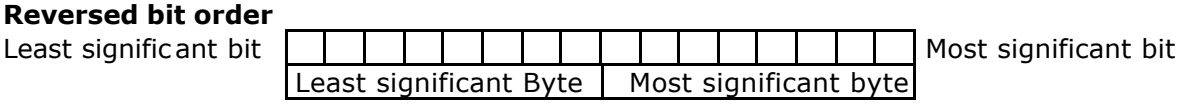
Thus, the polynomial has the value Hex A001.

9.2.2 Bit's order

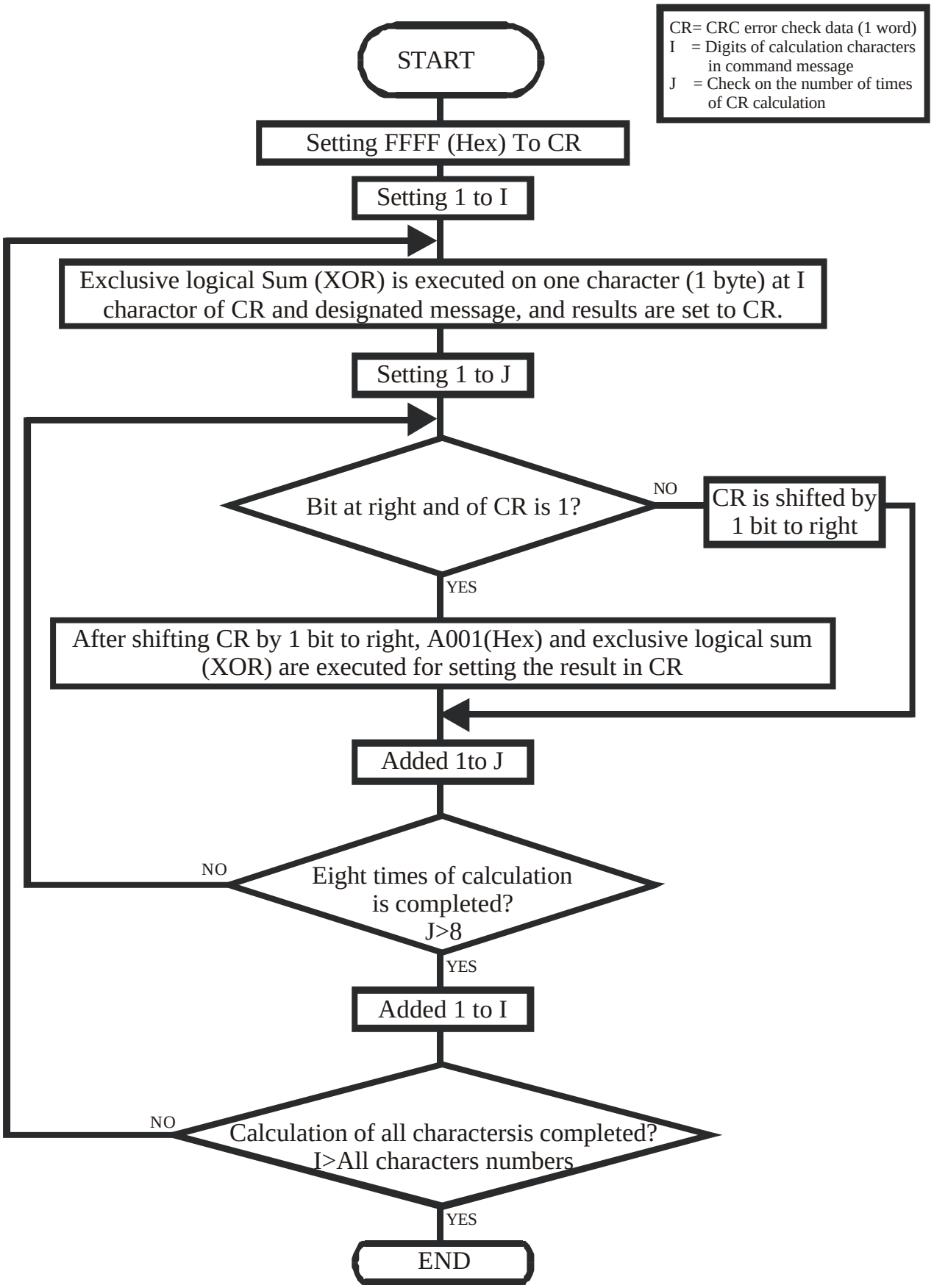
Normal bit order



Reversed bit order



N.B.: Reversed order apples, so CRC16 return Reversed bit order


CR= CRC error check data (1 word)
I = Digits of calculation characters in command message
J = Check on the number of times of CR calculation
START
Setting FFFF (Hex) To CR
Setting 1 to I
Exclusive logical Sum (XOR) is executed on one character (1 byte) at I charactor of CR and designated message, and results are set to CR.
Setting 1 to J
Bit at right and of CR is 1?
NO
CR is shifted by 1 bit to right
YES
After shifting CR by 1 bit to right, A001(Hex) and exclusive logical sum (XOR) are executed for setting the result in CR
Added 1to J
NO
Eight times of calculation is completed?
J>8
YES
Added 1 to I
NO
Calculation of all charactersis completed?
I>All characters numbers
YES
END

9.2.3 C Language CRC 16 Example

```
static short CRC16 (unsigned char *p_first,unsigned char *p_last)
{
        unsigned int crc=0xffff;
        short j;

        for (;p_first<=p_last;p_first++)
        {
                crc ^= *p_first;
                for(j=8;j>0;j--)
                {
                if(crc & 0x0001)
                        {
                        crc = crc >> 1;
                        crc ^= 0xA001;
                        }
                else
                        {
                        crc = crc >> 1;
                        }
                }

        }
return (crc);
}
```

9.2.4 Read Holding Registers (Read n Words) – Function 03

The message sent to the Controller to obtain the value of one or more registers comprises the following eight bytes:

Addr. unit	**Func.**	**Address 1° word**		**N° of Word**		**CRC 16**	
	3 3Hex	HI	LO	HI	LO	HI	LO

The normal reply will echo the first two characters of the message received followed by a single-byte data byte count (which will not include itself or the CRC).
For this message, the count value equals the number of parameter values read multiplied by two.
Following the byte count, the specified number of parameter values are transmitted, followed by the CRC16 bytes:

Addr. unit	**Func.**	**Cont.**	**1° Value**			**Last Value**		**CRC 16**	
	3 3Hex		HI	LO		HI	LO	HI	LO

9.2.5 Preset Multiple Registers (Write n Words) - Function 16

This is an eleven-byte message. only one parameter may be written for each received message. The usual pre-amble is followed by the address of the parameter to be written, a two-byte word count (always set to 1), a single-byte byte count (always set to 2), the value to be written and the CRC16 bytes:

Addr. unit	**Func.**	**Addr of 1° Word**		**N° of Word**		**Cont.**	**Valore**		**CRC 16**	
	16 10Hex	HI	LO	0	1	2	HI	LO	HI	LO

The Controller normally responds with the following eight-bit reply:

Addr. unit	**Func.**	**N° of Word**		**N° Word**		**CRC 16**	
	16 10Hex	HI	LO	0	1	HI	LO

9.2.6 Error and Exception Responses

If a received message contains a corrupted character (parity check failure, framing error etc.) or if the CRC16 check fails, or if the received message is otherwise syntactically flawed (e.g. byte count or word count is incorrect), the thyristor will ignore that message.

If the received message is syntactically correct but nonetheless contains an illegal value, the thyristor will send a five-byte exception response as follows:

Addr. unit	**Func.**	**N.Exception**	**CRC 16**	
			HI	LO

The Function Number byte contains the function number contained in the message which caused the error, with its top bit set (i.e. Function 3 becomes 0x83) and the Exception Number is on of the following codes:

Code	**Name**	**Cause**
1	ILLEGAL FUNCTION	Function number out of range
2	ILLEGAL DATA ADDRES	Parameter ID out of range or not supported
3	ILLEGAL DATA VALUE	Attempt to write invalid data/required action not executed

NOTE: Writing a parameter value equal to its current value is a valid transaction; this will not cause an error response.

9.3 Word parameters

Parameter	**N.**	**Notes**
Heater nominal current	1	Read only
Set-point HB	2	Read /write
Status Table (shown in Tab 2.1.2)	3	Read only
Comand Table (shown in Tab 2.1.3)	4	Read /write
Output Power (0 – FFH)	5	Read - (Write if BIT1in Command table i = 1) (0->0% - FF->100%)
Power Adjust (0 – FFH)	6	Read -- (Write if BIT1in Command table i = 1) (0->0% - FF->100%)*

9.3.1 Heater nominal current **Parameter 1**
Operation: Read

Meaning:
It correspond at one value in points (0-255,0-FF Hex).
It represents average current value flowing into thyristors.
Value depends on current transformer ratio that is different from one size to the other one (see below table)

Nominal current (A)	**Zero (0 , 0 Hex)** (A)	**Max (255 , ff Hex) (A)**
3,5	0	3,5
15	0	25
25	0	25
35	0	50
45	0	50
60	0	100
90	0	100
110	0	100

9.3.2 Set-point HB **Parameter 2**

Operations: Read/Write

Meaning:
It correspond at one value in points (0-255, o-FF Hex). It's the set of current value below which HB alarm occurs.
This value is the load current minus % value of parameter 124H. This value depend on nominal current of transformer that change in function of thyristor nominal current as described in below tab.

Nominal current (A)	Zero (0 , 0 Hex) (A)	Max (255 , ff Hex) (A)
3,5	0	3,5
15	0	25
25	0	25
35	0	50
45	0	50
60	0	100
90	0	100
110	0	100

9.3.3 Status Table **Parameter 3**

Operations: Read

Meaning:
It's a tab in bit that represent the "Status" of thyristor unit

9.3.4 Comand Table **Parameter 4**

Operations: Read/Write

Meaning:
It's a tab in bit for remote commands via RS485 (see tab)

9.3.5 Output Power **Parameter 5**

Command from controller
Operations: Read

Meaning:
It rapresent a value in points (0-255, 0-FF Hex) and it's the power demand in % of controller.

Example:
0% = 0 0 (Hex)
50% = 128 80 (Hex)
100% = 255 FF (Hex)

Command via RS485
Operations : Read/Write

Meaning:
It's a value in points (0-255, 0-FF Hex)
It's power set point setted in thirst buffer

Example:
0% = 0 0 (Hex)
50% = 128 80 (Hex)
100% = 255 FF (Hex)

9.3.6 Power adjust **Parameter 6**
Operations: Read/Write

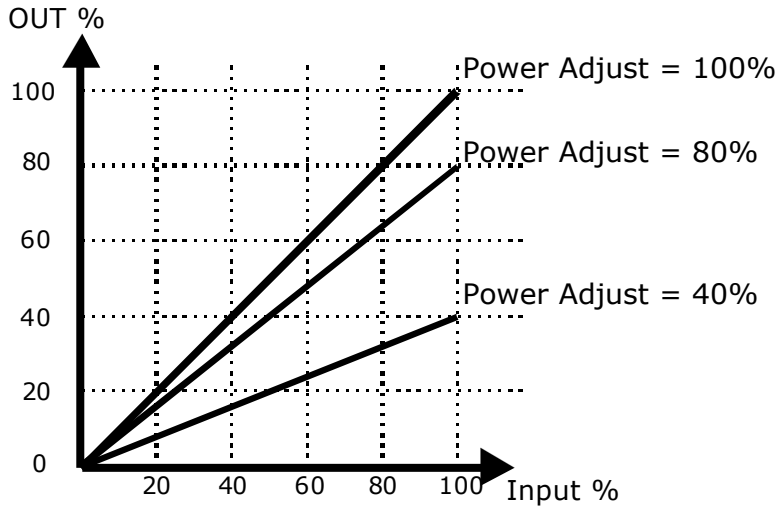
Meaning:
Its' a value in points (0-255, 0-FF Hex)
Its' a scaling factor of power demand

Example 1:

0% = 0
50% = 128
100% = 255

Example 2:

- Output Power :100
  Power Limit :100
  -> Power real : 100
- Output Power :100
  Power Limit :50
  -> Power real : 50
- Output Power :80
  Power Limit :50
  -> Power real : 40



9.3.7 Status Table

Bit	Meaning	Notes
0	Short circuit on SCR	Read only
1	Load Failure	Read only
2	On-Off	Read only
3	HB Calibration in progress	Read only 0=Normal - 1=Calibration

9.3.7.1 Short circuit on SCR *Bit 0*

Operations: Read

Meaning:
Its' a status but that represents the short circuit on thyristor

0 = OK
1 = Short circuit

9.3.7.2 Load Failure *Bit 1*

Operations: Read

Meaning:
It's a bit that represent partial or total load failure.

0 = OK
1 = Load failure

9.3.7.3 On-Off *Bit 2*

Operations: Read

Meaning:
It's a bit that represent when input signal is ON

0 = Input signal OFF
1 = Input signal ON

9.3.7.4 HB Calibration in progress *Bit 3*

Operations: Read

Meaning:
It's a bit status that represent "calibration in progress"

0 = No calibration
1 = Calibration in progress

9.3.8 Command Table

Bit	Meaning	Notes
0	HB Calibration	Read /write 0=Off - 1=ACTVATE Calibration (normal mode set to 0)
1	Firing command	Read /write 0=from terminal - 1=from RS485
2	On-Off	Read /write 0=Off - 1=On
3	RESET HB	Read /write 0=Off - 1=RESET (normal mode set to 0)

N.B.: When unit is switch off all command parameter are set to 0

9.3.8.1 HB Calibration *Bit 0*

Operations: Read / Write

Meaning:
It's a bit that starts the HB calibration procedure
When this bit is zero start the calibration procedure and reset itself automatically at the end.

9.3.8.2 Firing command *Bit 1*

Operations: Read / Write

Meaning:
It's a command bit used to switch from analog external command to command via RS485

0 = Command of analog input
1 = Command of RS485 input

9.3.8.3 On-Off *Bit 2*

Operations: Read / Write

Meaning:
Its' an enable bit to switch ON-OFF the power.

0 = Power disabled
1 = Power enabled

9.3.8.4 HB RESET *Bit 3*

Operations: Read / Write

Meaning:
It's a command bit to reset HB alarm.
This parameter has to be at 0 to have the alarm working properly

0 = Reset disabled
1 = Reset enabled

9.4 Thyristor unit Configuration

Parameter	N.	Notes
Password	123	Write
Delay trigger	124L	Read /write
% HB	124H	Read /write
Firing type	125L	Read /write
Soft start time	125H	Read /write
N° burst	126L	Read /write
Delay time HB	126H	Read /write
Max power for SSR Input	127L	Read /write
Cycle time	127H	Read /write
N° of half period for Delayed triggering	128L	Read /write (Mantenere a 1)
	128H	Read /write

9.4.1 Password **Parameter 123**
Operations: Write

Meaning:
If properly setted give the access to configuration

9.4.2 Delay triggering **Parameter 124L**
Operations: Read/Write

Meaning:
It's correspond to a value in points (0-50, 0-32 Hex)
Each step is 0,1msec. Range is 0-5msec.
This parameter is the delay of firig in first half period with respect zero voltage crossing.

9.4.3 % HB **Parameter 124H**
Operations: Read/Write

Meaning:
It's correspond to a value in point (0-255, 0-ff Hex)
This parameter is the value in % that decrease the load current to establish the HB current set point

Example:

Load current = 10A
Parameter 124H = 20% 51 Dec 33 Hex
Parameter 2 will be setted at 8A

9.4.4 Firing type **Parameter 125L**

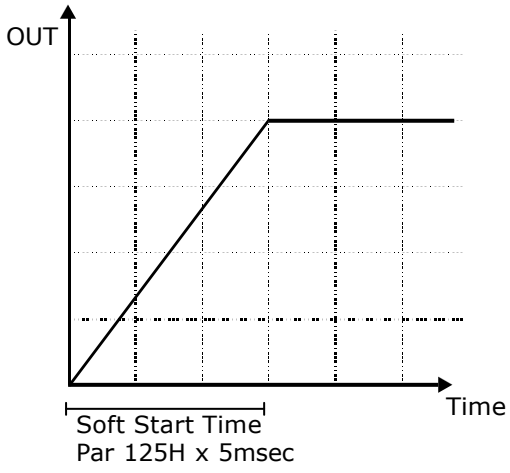
Operations: Read/Write

Meaning:
Selection table of firing modes.

Value		**Type**	**Option**
H	L		
0	1	Zero Crossing	-
0	2	Single Cycle	-
0	3	Burst	-
1	1	Zero Crossing	Soft Start
1	2	Single Cycle	-
1	3	Burst	Soft Start
2	1	Zero Crossino	Delay trigger
2	2	Single Cycle	
2	3	Burst	Delay triggering
2	4	Phase angle	Soft start

9.4.5 Soft start time **Parameter 125H**

Operations: Read/Write



Meaning :
It's correspond to a value in points (0 – 255, 0 – FF Hex).
Each step is 5msec .

The unit start in phase angle mode with a ramp starting from zero up to full voltage in a presetted and Adjustable time.
The time is setted by this parameter.

Value of this parameter must be less than cycle time.

For burst firing:
Value of this parameter must be less than:
50Hz -> 20msec x Number of cycles (Parameter 126L).
60Hz -> 16,6msec x Number of cycles (Parameter 126L).

9.4.6 N° burst **Parameter 126L**
Operations: Read/Write

Meaning:
It's a value in point (0 – 255, 0 – FF Hex).
In burst firing mode it rapresents the number of cycles at 50% power demand

9.4.7 Delay time HB **Parameter 126H**
Operations: Read/Write

Meaning:
It's a value in point (0 – 255, 0 – FF Hex).
Each step is 50msec.
It represent a delay to have HB alarm active

When is used soft start this time must be longer than soft start time.
Par126H x 50msec > Par125H x 5msec

When zero crossing firing is used must be less than cycle time
Par126H x 50msec > Par127H x 50msec

9.4.8 Max power for SSR Input **Parameter 127L**
Operations: Read/Write

Meaning:
It's a value in points (0 – 255, 0 – FF Hex).

When SSR input is used it represent the value of the power (%) when is in ON status.

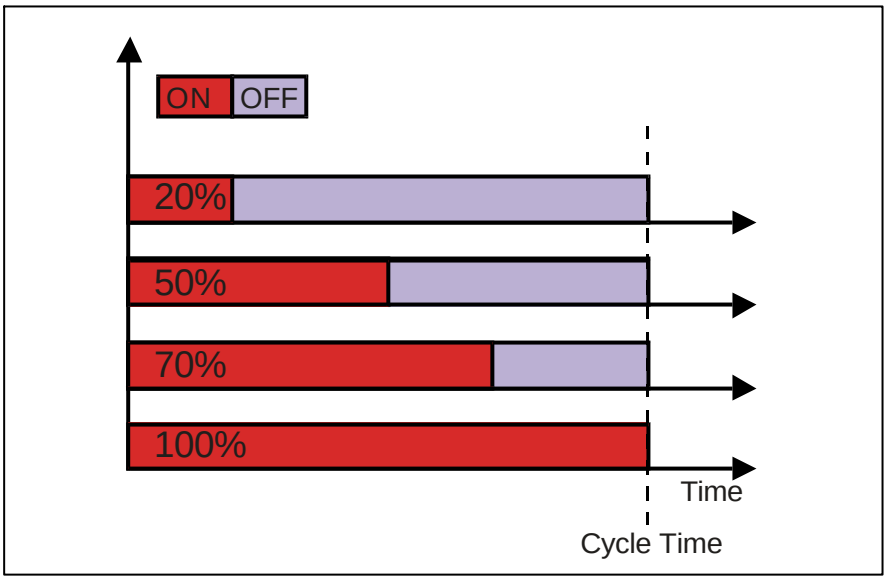
It's the power % when firing command is given on RS485 (1).

Example:

0%	= 0	0 (Hex)
50%	= 128	80 (Hex)
100%	= 255	FF (Hex)

9.4.9 Cycle time **Parameter 127H**
Operations: Read/Write

Meaning:
It's a value in points (0 – 255, 0 – FF Hex).
Each step is 50msec .



When single cycle (SC) and burst firing (BF) is used must be setted at 240 (FO Hex)

When SSR input is used set at 240 (FO Hex)

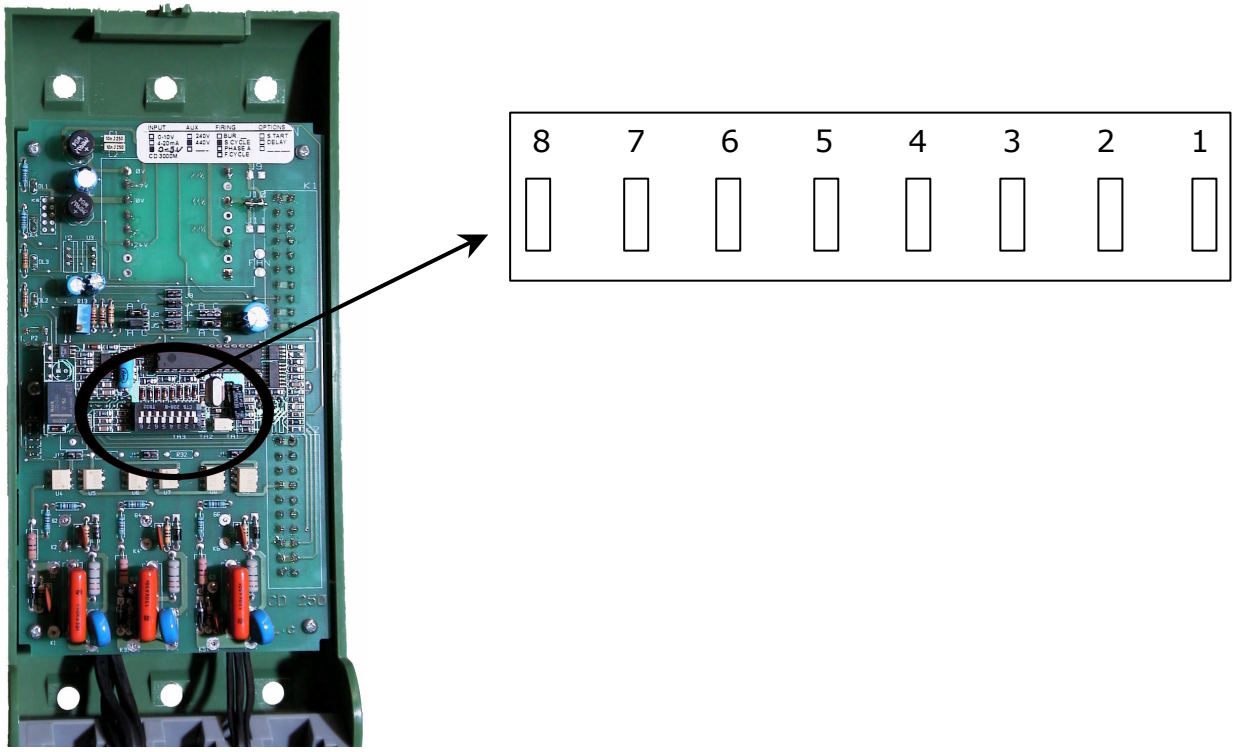
When is used zero crossing (ZC) represents the cycle time
(ON time + OFF time, default 60(3C Hex))

9.4.10 Number of half periods for DT firing **Parameter 128L**
Operations: Read/Write

Meaning:
Must be setted at 1.

9.5 Address Configuration

Up to 255 CD3000M units, each with a unique address, may be connected to a master device.
To configure communication address open cover and set the dip-switch as specified



9.5.1 Address table

ID	8	7	6	5	4	3	2	1
1	-	-	-	-	-	-	-	X
2	-	-	-	-	-	-	X	-
3	-	-	-	-	-	-	X	X
4	-	-	-	-	-	X	-	-
5	-	-	-	-	-	X	-	X
6	-	-	-	-	-	X	X	-
7	-	-	-	-	-	X	X	X
8	-	-	-	-	X	-	-	-
9	-	-	-	-	X	-	-	X
10	-	-	-	-	X	-	X	-
11	-	-	-	-	X	-	X	X
12	-	-	-	-	X	X	-	-
13	-	-	-	-	X	X	-	X
14	-	-	-	-	X	X	X	-
15	-	-	-	-	X	X	X	X
16	-	-	-	X	-	-	-	-
17	-	-	-	X	-	-	-	X
18	-	-	-	X	-	-	X	-
19	-	-	-	X	-	-	X	X
20	-	-	-	X	-	X	-	-
21	-	-	-	X	-	X	-	X
22	-	-	-	X	-	X	X	-
23	-	-	-	X	-	X	X	X
24	-	-	-	X	X	-	-	-
25	-	-	-	X	X	-	-	X

ID	8	7	6	5	4	3	2	1
26	-	-	-	X	X	-	X	-
27	-	-	-	X	X	-	X	X
28	-	-	-	X	X	X	-	-
29	-	-	-	X	X	X	-	X
30	-	-	-	X	X	X	X	-
31	-	-	-	X	X	X	X	X
32	-	-	X	-	-	-	-	-
33	-	-	X	-	-	-	-	X
34	-	-	X	-	-	-	X	-
35	-	-	X	-	-	-	X	X
36	-	-	X	-	-	X	-	-
37	-	-	X	-	-	X	-	X
38	-	-	X	-	-	X	X	-
39	-	-	X	-	-	X	X	X
40	-	-	X	-	X	-	-	-
41	-	-	X	-	X	-	-	X
42	-	-	X	-	X	-	X	-
43	-	-	X	-	X	-	X	X
44	-	-	X	-	X	X	-	-
45	-	-	X	-	X	X	-	X
46	-	-	X	-	X	X	X	-
47	-	-	X	-	X	X	X	X
48	-	-	X	X	-	-	-	-
49	-	-	X	X	-	-	-	X
50	-	-	X	X	-	-	X	-

ID	8	7	6	5	4	3	2	1
51	-	-	X	X	-	-	X	X
52	-	-	X	X	-	X	-	-
53	-	-	X	X	-	X	-	X
54	-	-	X	X	-	X	X	-
55	-	-	X	X	-	X	X	X
56	-	-	X	X	X	-	-	-
57	-	-	X	X	X	-	-	X
58	-	-	X	X	X	-	X	-
59	-	-	X	X	X	-	X	X
60	-	-	X	X	X	X	-	-
61	-	-	X	X	X	X	-	X
62	-	-	X	X	X	X	X	-
63	-	-	X	X	X	X	X	X
64	-	X	-	-	-	-	-	-
65	-	X	-	-	-	-	-	X
66	-	X	-	-	-	-	X	-
67	-	X	-	-	-	-	X	X
68	-	X	-	-	-	X	-	-
69	-	X	-	-	-	X	-	X
70	-	X	-	-	-	X	X	-
71	-	X	-	-	-	X	X	X
72	-	X	-	-	X	-	-	-
73	-	X	-	-	X	-	-	X
74	-	X	-	-	X	-	X	-
75	-	X	-	-	X	-	X	X
76	-	X	-	-	X	X	-	-
77	-	X	-	-	X	X	-	X
78	-	X	-	-	X	X	X	-
79	-	X	-	-	X	X	X	X
80	-	X	-	X	-	-	-	-
81	-	X	-	X	-	-	-	X
82	-	X	-	X	-	-	X	-
83	-	X	-	X	-	-	X	X
84	-	X	-	X	-	X	-	-
85	-	X	-	X	-	X	-	X
86	-	X	-	X	-	X	X	-
87	-	X	-	X	-	X	X	X
88	-	X	-	X	X	-	-	-
89	-	X	-	X	X	-	-	X
90	-	X	-	X	X	-	X	-
91	-	X	-	X	X	-	X	X
92	-	X	-	X	X	X	-	-
93	-	X	-	X	X	X	-	X
94	-	X	-	X	X	X	X	-
95	-	X	-	X	X	X	X	X
96	-	X	X	-	-	-	-	-
97	-	X	X	-	-	-	-	X
98	-	X	X	-	-	-	X	-
99	-	X	X	-	-	-	X	X
100	-	X	X	-	-	X	-	-

ID	8	7	6	5	4	3	2	1
101	-	X	X	-	-	X	-	X
102	-	X	X	-	-	X	X	-
103	-	X	X	-	-	X	X	X
104	-	X	X	-	X	-	-	-
105	-	X	X	-	X	-	-	X
106	-	X	X	-	X	-	X	-
107	-	X	X	-	X	-	X	X
108	-	X	X	-	X	X	-	-
109	-	X	X	-	X	X	-	X
110	-	X	X	-	X	X	X	-
111	-	X	X	-	X	X	X	X
112	-	X	X	X	-	-	-	-
113	-	X	X	X	-	-	-	X
114	-	X	X	X	-	-	X	-
115	-	X	X	X	-	-	X	X
116	-	X	X	X	-	X	-	-
117	-	X	X	X	-	X	-	X
118	-	X	X	X	-	X	X	-
119	-	X	X	X	-	X	X	X
120	-	X	X	X	X	-	-	-
121	-	X	X	X	X	-	-	X
122	-	X	X	X	X	-	X	-
123	-	X	X	X	X	-	X	X
124	-	X	X	X	X	X	-	-
125	-	X	X	X	X	X	-	X
126	-	X	X	X	X	X	X	-
127	-	X	X	X	X	X	X	X
128	X	-	-	-	-	-	-	-
129	X	-	-	-	-	-	-	X
130	X	-	-	-	-	-	X	-
131	X	-	-	-	-	-	X	X
132	X	-	-	-	-	X	-	-
133	X	-	-	-	-	X	-	X
134	X	-	-	-	-	X	X	-
135	X	-	-	-	-	X	X	X
136	X	-	-	-	X	-	-	-
137	X	-	-	-	X	-	-	X
138	X	-	-	-	X	-	X	-
139	X	-	-	-	X	-	X	X
140	X	-	-	-	X	X	-	-
141	X	-	-	-	X	X	-	X
142	X	-	-	-	X	X	X	-
143	X	-	-	-	X	X	X	X
144	X	-	-	X	-	-	-	-
145	X	-	-	X	-	-	-	X
146	X	-	-	X	-	-	X	-
147	X	-	-	X	-	-	X	X
148	X	-	-	X	-	X	-	-
149	X	-	-	X	-	X	-	X
150	X	-	-	X	-	X	X	-

ID	8	7	6	5	4	3	2	1
151	X	-	-	X	-	X	X	X
152	X	-	-	X	X	-	-	-
153	X	-	-	X	X	-	-	X
154	X	-	-	X	X	-	X	-
155	X	-	-	X	X	-	X	X
156	X	-	-	X	X	X	-	-
157	X	-	-	X	X	X	-	X
158	X	-	-	X	X	X	X	-
159	X	-	-	X	X	X	X	X
160	X	-	X	-	-	-	-	-
161	X	-	X	-	-	-	-	X
162	X	-	X	-	-	-	X	-
163	X	-	X	-	-	-	X	X
164	X	-	X	-	-	X	-	-
165	X	-	X	-	-	X	-	X
166	X	-	X	-	-	X	X	-
167	X	-	X	-	-	X	X	X
168	X	-	X	-	X	-	-	-
169	X	-	X	-	X	-	-	X
170	X	-	X	-	X	-	X	-
171	X	-	X	-	X	-	X	X
172	X	-	X	-	X	X	-	-
173	X	-	X	-	X	X	-	X
174	X	-	X	-	X	X	X	-
175	X	-	X	-	X	X	X	X
176	X	-	X	X	-	-	-	-
177	X	-	X	X	-	-	-	X
178	X	-	X	X	-	-	X	-
179	X	-	X	X	-	-	X	X
180	X	-	X	X	-	X	-	-
181	X	-	X	X	-	X	-	X
182	X	-	X	X	-	X	X	-
183	X	-	X	X	-	X	X	X
184	X	-	X	X	X	-	-	-
185	X	-	X	X	X	-	-	X
186	X	-	X	X	X	-	X	-
187	X	-	X	X	X	-	X	X
188	X	-	X	X	X	X	-	-
189	X	-	X	X	X	X	-	X
190	X	-	X	X	X	X	X	-
191	X	-	X	X	X	X	X	X
192	X	X	-	-	-	-	-	-
193	X	X	-	-	-	-	-	X
194	X	X	-	-	-	-	X	-
195	X	X	-	-	-	-	X	X
196	X	X	-	-	-	X	-	-
197	X	X	-	-	-	X	-	X
198	X	X	-	-	-	X	X	-
199	X	X	-	-	-	X	X	X
200	X	X	-	-	X	-	-	-

X	=	ON
-	=	OFF

ID	8	7	6	5	4	3	2	1
201	X	X	-	-	X	-	-	X
202	X	X	-	-	X	-	X	-
203	X	X	-	-	X	-	X	X
204	X	X	-	-	X	X	-	-
205	X	X	-	-	X	X	-	X
206	X	X	-	-	X	X	X	-
207	X	X	-	-	X	X	X	X
208	X	X	-	X	-	-	-	-
209	X	X	-	X	-	-	-	X
210	X	X	-	X	-	-	X	-
211	X	X	-	X	-	-	X	X
212	X	X	-	X	-	X	-	-
213	X	X	-	X	-	X	-	X
214	X	X	-	X	-	X	X	-
215	X	X	-	X	-	X	X	X
216	X	X	-	X	X	-	-	-
217	X	X	-	X	X	-	-	X
218	X	X	-	X	X	-	X	-
219	X	X	-	X	X	-	X	X
220	X	X	-	X	X	X	-	-
221	X	X	-	X	X	X	-	X
222	X	X	-	X	X	X	X	-
223	X	X	-	X	X	X	X	X
224	X	X	X	-	-	-	-	-
225	X	X	X	-	-	-	-	X
226	X	X	X	-	-	-	X	-
227	X	X	X	-	-	-	X	X
228	X	X	X	-	-	X	-	-
229	X	X	X	-	-	X	-	X
230	X	X	X	-	-	X	X	-
231	X	X	X	-	-	X	X	X
232	X	X	X	-	X	-	-	-
233	X	X	X	-	X	-	-	X
234	X	X	X	-	X	-	X	-
235	X	X	X	-	X	-	X	X
236	X	X	X	-	X	X	-	-
237	X	X	X	-	X	X	-	X
238	X	X	X	-	X	X	X	-
239	X	X	X	-	X	X	X	X
240	X	X	X	X	-	-	-	-
241	X	X	X	X	-	-	-	X
242	X	X	X	X	-	-	X	-
243	X	X	X	X	-	-	X	X
244	X	X	X	X	-	X	-	-
245	X	X	X	X	-	X	-	X
246	X	X	X	X	-	X	X	-
247	X	X	X	X	-	X	X	X
248	X	X	X	X	X	-	-	-
249	X	X	X	X	X	-	-	X
250	X	X	X	X	X	-	X	-
251	X	X	X	X	X	-	X	X
252	X	X	X	X	X	X		
253	X	X	X	X	X	X		X
254	X	X	X	X	X	X	X	
255	X	X	X	X	X	X	X	X

10. Maintenance

10.1 Trouble Shooting

Small problems sometimes can be solved locally with the help of the below tab of trouble shooting. If you don't succeed, contact us or your nearest distributor.

Symptom	**Indication on front unit**	**Possible reasons of the symptom**	**Actions**
	Green LED is always light off.	- No voltage auxiliary power supply to terminals 1-3 (see wiring diagram).	- Give auxiliary voltage supply to terminals 1-3.
Thyristor unit doesn't go in conduction with input signal.	Green LED (PW) light on and green LED (ON) in light off condition.	- No input signal. - Reversed polarities of input signal. - Reset contact in open condition (see wiring diagram).	- Provide to give input signal. - Reverse the input signal polarity. - Make link on reset terminals.
	Green LED (PW) in light on condition and green LED (ON) in light on condition.	- Fuse failure. - Load failure. - Load connection interruption. - Thyristor faulty and always in open circuit. - With HB option the yellow led (HB) in light on condition.	- Substitute the fuse. - Repair the load. - Provide to repair the wiring. - Substitute the faulty thyristor. - Check the load.
Load current flows also with no input signal.	Green LED (ON) always in light off condition.	- Short circuit on thyristor. If there is HB circuit the red LED (SC) is light on.	- Substitute the thyristor. Check that load is not in short circuit.
Current flows at nominal value but yellow LED (HB) in light on condition.	Yellow HB in light on condition.	- HB circuit not tuned. - Current transformers not properly wired (if are external to CD3000).	- Push CAL button in front unit to start HB calibration procedure. - Control current transformers wiring and Push CAL button in front unit to start HB calibration procedure.
Red LED (SC) is lighted also if current is at nominal value.	Red LED in light on condition.	- HB circuit not properly tuned.	- Push CAL button in front unit to start HB calibration procedure.
Thyristor unit doesn't work properly.		- Wrong input signal selection. - Wrong input signal calibration (out of range). - Auxiliary voltage supply out of limits.	- Control input signal setting. - Repeat input calibration procedure. - Verify the auxiliary voltage supply.

10.2 Repairing procedure

- Phone to us.
- Explain to Service Engineer the problem because sometimes it can be solved with a phone call.
- If this is not possible ship the unit to us or to your distributor.
- Write a fault description and give the name of your personnel to which refer.
- Use a rugged packaging to ship the unit.

10.3 Fans

The thyristor unit with forced ventilation uses fans that rotate permanently when the unit is supplied. In case of accidental fan failure, there is an over heating temperature on heatsink. In this case to give protection to thyristor there is a thermal switch properly setted. The function of this switch is to open the input signal until the heatsink temperature falls below the setted value. This means that also with input signal in ON condition the unit is switched OFF and the system can not work at full power. For these reason is important to control periodically the fan status checking that is rotating.

10.4 Servicing

In order to have correct cooling, the user must clean the heatsink and the protective grill of fan. The frequence of this servicing depends on environmental pollution.
Check periodically also if the screw for the power cables and safety earth are tightened correctly

10.5 Warranty conditions

We gives a 12 months warranty to its products. The warranty is limited to repairing and parts substitution in our factory and does exclude products not properly used and fuses.
Warranty does not includes products with serial numbers deleted. The faulty product should be shipped to us at your cost and our Service will evaluate if product is under warranty terms.
Substituted parts remains our property.

11. CD Automation's distributors

For a more precise and rapid service, please contact the distributor nearest to you:

ITALY	
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